



## Acid spill from train

A railway worker picks his way through the mass of toppled tank cars, shredded ties and bent rails after a train derailment spilled tons of acid into farmlands and ditches outside Welland. (see Report, pictures, Pages 4 and 5.)

ENVIRONMENT  
ONTARIO

LEGACY

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# Keep it beautiful on the road

For the first time in Ontario's history, provincial licence plates are carrying a message—Ontario—Keep It Beautiful—as a continuing reminder of the need for public vigilance to protect our environment.

"This is especially appropriate in view of the number of environmental problems that revolve around the automobile," said Premier William Davis. "In congested urban conditions, the auto can be a

significant contributor to air pollution, and we have discovered that traffic sounds are Ontario's major noise problem."

Automobiles and their drivers affect more than the cities, Mr. Davis said. "A worn-out car, abandoned at the roadside or in a field becomes an unsightly blot on the landscape."

### SURVEY DERELICTS

ENVIRONMENT Minister James Auld agreed. He said

detailed survey work conducted over the past summer has given Ontario a clear indication of the extent of these problems.

"Our preliminary estimates indicate there are at the very least 400,000 abandoned cars scattered over the face of the province, and their number is growing every day," he said. "During the next three years, these hulks will be removed and processed for re-use. We

are considering a small disposal charge to provide funds for cleaning up this backlog and to establish a continuing program so that this situation never recurs."

Commenting on roadside litter, Mr. Auld said: "We can affect air and water pollution control and waste management programs, especially with the co-operation of industry. We can work on the problems of packaging, including throw-

way packaging, with the producers and marketers."

### PERSONAL CONCERN

"But the individual bears the ultimate responsibility for where he discards his personal trash," Mr. Auld said. "We can only try to persuade him—to develop his personal concern in making Ontario a better place to live."

Environment Ontario over the past summer launched an all-out drive to reach the public with the anti-litter message. This drive included radio, television and newspaper advertising, free-time public service messages, billboards and posters. It was backed up with a survey of roadside litter conducted by students hired under the province's Project SWEET.

A parallel campaign was maintained by the container and bottling industry. "We've had reports from some of the people who ran the Littercheck program that this summer of public education has affected litter by as much as 20 or 30 percent," Mr. Auld said.

Mr. Auld said the Ministry of the Environment has not yet established definite statistics. The results of the SWEET survey are being tabulated, a report has been prepared on the campaign and the overall results of the summer's activities will be fed into the recently announced Task Force on Solid Waste.

"But the preliminary information I have seen is promising. I am sure that every man, woman and child has been exposed to the idea of keeping Ontario beautiful and I hope the phrase on the licence plates will act as a continuing reminder."

He said the response to the summer campaign has been encouraging with about 60 municipalities ordering and using litter container signs and litter posters, and a number of commercial firms using the Ministry's display materials.

# Hamilton plant to re-use steel

Cash for trash.

That's the slogan that adequately describes the new detinning operation which will soon tie in with the new SWARU solid waste reduction unit in Hamilton.

M & T Products of Canada has offered to buy all the steel scrap magnetically separated at the city's new plant. The operation would generate \$25,000 annually for the city of Hamilton.

It has been estimated that the plant will reclaim about 6000 tons a year of usable scrap steel, and included in this total will be 80 million used food and beverage cans from the household refuse of Hamilton.

In addition to the proposal, the Metal Container Manufacturers' Advisory Council has also offered to finance the installation of modifications to the plant that will make acceptable for detinning all ferrous metal extracted from the collected waste. This will represent the first practical recovery of any waste material by a Canadian municipality.

The recovery of steel and the recycling process will begin in April when modifications to the magnetic separation system have been completed. While this work is in progress, M & T will make

changes to its detinning operations to accept combination steel and aluminum beverage cans.

### OPERATIONS

Daily collections of scrap steel from the SWARU facility will be taken four miles away to M & T's where it will be treated to a caustic bath to remove the tin coating. The tin will be reclaimed at potassium stannate and this will be sold to manufacturers for reuse in tinning processes. The scrap steel will be shipped to Steeleo and Dofasco for re-

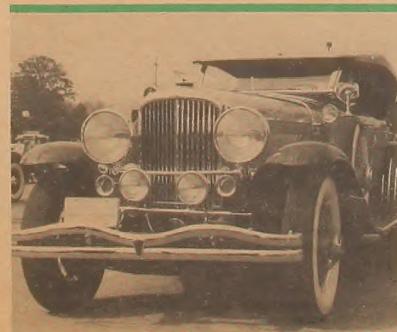
cycling into usable steel products.

Roughly 65 per cent of the scrap will consist of food and beverage cans. The balance will comprise jar tops, coat hangers, nails, wire and numerous other steel-based items.

The city of Hamilton will reimburse MCMAC for the capital costs of the modifications to the plant's magnetic system. The cost of these changes will be retired through the income raised by the sale of the scrap metal within three years. After the

equipment has been paid for, the city will then receive full price for the metal.

Mr. Ken Bethune, spokesman for MCMAC and a member of Ontario's Task Force on Solid Waste, said, "It is appropriate that this Canadian 'first' should occur in Hamilton, home of Canada's two major producers of tin plate for use in the manufacture of steel containers. Wherever major cities are in close proximity to a steel mill, the possibility exists of working out similar arrangements."



## Auto emissions special report

"Inhale the glorious aroma and weep for the bellowing, smoky monsters we will never know again."

That sentence closed the late Ken Purdy's book, *Kings Of The Road*, a romantic look at the great autos of yesterday.

In this issue, Legacy looks at the future of the automobile in respect to air pollution and the environment.

# Briefly: From beer to fishing

## BEER BOTTLES TO PIPE



Recycling beer bottles into sewer pipe sounds like a drinking environmentalist's pipe dream, but researchers in New York state claim it's a serious proposition. Ten sections of sewer pipe recently installed in Huntington, N.Y., were each made from the equivalent of 118 beer bottles.

The bottles—all non-returnables—were trucked from recycling depots 40 miles to the laboratory. There they were crushed, labels, caps and all, and mixed with a liquid plastic called monomer.

The mix was poured into a mold to make pipe and then cured.

Unfortunately no estimates are yet available on the cost and feasibility of producing the new glasspipe in quantity.

## PCAO 1973 CONFERENCE

The 1973 annual conference of the Pollution Control Association of Ontario will be held at the Sheraton Connaught Hotel in Hamilton Ontario on Monday through Wednesday, April 9 to 11.

The PCAO, a member association of the Water Pollution Control Federation a scientific society promoting better control and utilization of the environment. It's expected that 250-300 will attend the conference, representing municipalities, consulting engineering firms, industrial concerns, cottage associations and conservationist groups.

## PHOSPHATES

Phosphates, the much-touted ingredients for that whiter than white wash, don't always deliver the best results, according to a study recently released by the Canada Centre for Inland Waters.

While phosphates or NTA produce better results with pure cotton fabrics, more and more modern clothing is made from synthetic or combined fabrics. And some of these fabrics wash whitest when done with completely phosphate-free detergents, the study concluded.

The federal government has ruled that effective January 1, 1973, the phosphorus content of laundry detergent is limited to a maximum of five percent.

## GOOD FISHING

Two U.S. tire manufacturers have put their discarded to use, building a 17,000-tire reef off Marco Island, Florida. The new reef has attracted at least 33 species of fish and local fishermen have scored record catches. So the anglers are enthusiastic about the tire manufacturers' request for U.S. government approval to make another reef.

Meanwhile, in British Columbia, researchers have been investigating the effect of sewage and fertilizer on fish growth. The Chinese tried it centuries ago and found that enrichment of nutrient-poor lake did wonders for fish growth.

In B.C., they claim a 30 percent increase in the growth rate of sockeye salmon so far.

## SANITARY PIPELINES

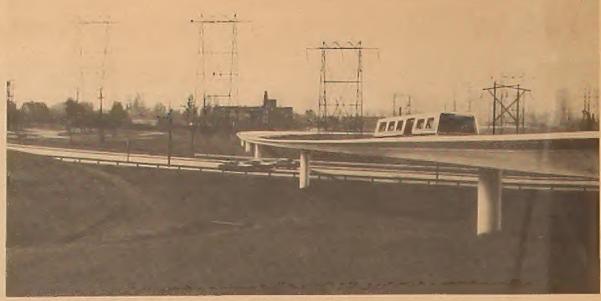
Environment Canada is investigating the possibility of moving sewage in high-pressure pipelines—the same system used to move gas and oil long distances.

"Current methods... are based on gravity flow and go back to the days of the Roman aqueducts," said Federal Environment Minister Jack Davis. "I hope we can improve on that." The consulting firm of Archer, Seader and Associates have been retained to conduct a study at an estimated cost of \$90,000.

## WATER COURSES

The 18th Summer Institute in Water Pollution Control is offering two one-week courses for engineers in biological waste treatment and mathematical modeling of natural water systems starting May 21.

The courses, at Manhattan College, Bronx, N.Y., are part of a continuing engineering education program for practising engineers and scientists in Government, Industry, consulting firms, research and academic institutions. For details, write Donald J. O'Connor, Environmental Engineering and Science Program, Manhattan College, Bronx, N.Y. 10471.



Construction cost is lower than either expressway or subway.

# New look announced for Ontario transit

Since December 1, the Ontario Government has offered grants of up to 75 percent of costs to encourage innovation in municipal public transit systems.

The program will cost the government \$1.35 billion over the next decade. Premier William Davis indicated as he and Gordon Carton, Minister of Transportation and Communications unveiled the program at a special conference at Ontario Place.

The 75 percent subsidies will apply to the municipal purchase of buses, street cars and trolley buses and facilities. They will also be available to assist municipalities in working out their own applications of a prototype new system of transportation soon to be developed by Ontario.

He added that the cost of subways have reached such high levels that few municipalities in the world can continue building them. The present cost of subway construction is \$25 million to \$30 million a mile.

The intermediate-capacity system proposed for Toronto is expected to average \$13.4 million a mile, including all equipment, stations, yards and facilities, for Hamilton, \$16.5 million a mile and for Ottawa, \$17.1 million.

portation planning among the municipalities in the province.

Mr. Davis stressed that the new transportation policy will be developed with the quality of community life and the environment as major considerations.

"As a means of solving our urban transportation problems, expressways are not only too expensive for the traffic moved, but because of their accompanying intrusion, noise and air pollution, they have become unacceptable in residential areas," Mr. Davis said.

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## IMPACT

All these proposals use existing corridors for minimum disruption.

The systems being considered are designed for elevated guideways. They are lightweight, electrically powered vehicles that operate quietly and unobtrusively. Electrical power means no air pollution problems along the guideways and the designs are tailored to pre-

sent a minimum of noise problems.

The guideways are to be supported by columns about 16 feet high, spaced from 60 to 100 feet apart. In most cases, stations too will be elevated—possibly even incorporated into the second level of large commercial buildings.

Air pollution and noise are the major undesirable elements of public transit that the new proposals are designed to overcome.

The designers specify electric motors—in some cases, linear induction motors with no revolving shafts, just a steady pull of electromagnetic power along the guideway.

The vehicles are suspended on the guideways with rubber tires, or air cushions.

At a distance of 50 feet, current transit systems, including expressways, put out noise levels of 80 to 100 decibels on the A scale. The new systems should not exceed 60 decibels—about the level of a home air conditioner.

The reduction is significant. Each reduction of 10 decibels approximately halves the amount of noise.

The vehicles in current proposals each carry from 20 to 25 passengers. They can run alone or in trains. Three systems have been selected from eight designs originally submitted. The developers of these three systems will submit technical design and cost proposals early in 1973 and one will be selected for construction and demonstration at the Canadian National Exhibition.



System is quiet, vibration-free, non-polluting, and compatible with surroundings.

# New plant provides steam, scrap steel.

When Hamilton, Ontario, set out to build a garbage incinerator, it approached the problem from a slightly different viewpoint.

It built a manufacturing plant. Its products are steel, ash and steam.

Of course the plant differs in many respects from normal manufacturing practices. The main product, the ash, is used for landfill, and the byproducts—steam and metal—are

the saleable commodities they expect to sell.

Gordon L. Sutin, whose engineering firm was selected as consultants on the \$8,200,000 solid waste reduction unit, said negotiations are now under way to sell these byproducts, thereby reducing the \$3.50 per ton operating cost of the incinerator.

The plant has unique features, he said, which significantly lower the operating

costs as compared to equally sophisticated equipment elsewhere.

## 600 TONS A DAY

The East Hamilton SWARU, as it is called, is designed to take in as raw material 450 tons of mixed municipal refuse and 150 tons of demolition lumber a day. It is now undergoing start-up and operates at about 50 percent of capacity.

Over the next three months,

Mr. Sutin said, it is expected to reach full production as mechanical problems are worked out.

A refuse truck enters the plant by one of two drive-through ramps which pass a 40 foot by 80 foot unloading pit. Conveyors at the bottom of these pits carries refuse to the top of the feed chute of a vertical shaft pulverizer.

Hammers in this pulverizer throw out metal objects too

large to grind and the rest of the refuse is ground progressively finer as it falls down the pulverizer.

Other conveyor belts carry the pulverized refuse through a magnetic metal separator where ferrous metal is removed and taken to the same container where heavy metal objects rejected by the pulverizer have been carried for periodic pickup by a scrap metal salvage unit.

## DUSTLESS

The pulverizer is designed to draw down any dust created in its operation and keep it in the main material flow. This whole unit is encased in a modern, attractive building which keeps the noise of grinding down.

The pulverized refuse is conveyed to a covered storage tank. A regulated flow from this tank feeds two furnaces.

The fine particles burn easily and completely—most of them in suspension before they hit the grates of the furnaces—leaving a residue that is about 10 percent of the refuse's original volume.

This ash falls to another conveyor which carries it out of the building for storage or removal to a landfill site.

Fly ash and other particles in the gases of the furnaces are removed by two large electrostatic precipitators so the solid waste problem does not become an air pollution problem. These particles join the main flow of ash.

## RECYCLED STEAM

Steam generating boilers are installed on the two furnaces. This steam is used within the plant for heat, controlling exhaust gas temperatures for efficient precipitator operation and for driving heavy horsepower in-plant equipment through steam turbines.



Environment Minister James Auld helps Premier William Davis install the first Ontario licence plates to carry the phrase, 'Keep It Beautiful'. Transportation and Communications Minister Gordon Carton issued the plates as a preview for Mr. Davis's car when the new licences went on sale.

## The snow disposal problem—no easy solution.

Analyses conducted by the Ministry of the Environment and other agencies over the past few years have shown that snow taken from roadways may contain a high concentration of suspended solids, dissolved salts, organic and nutrient materials and other contaminants.

Until recently much of this snow was dumped into lakes and rivers, or onto the ice on a watercourse. This was obviously a quick and effective disposal method but posed the problem of a high concentration of contaminants getting into our water.

To minimize the polluting effects of these materials, Environment Ontario issued a statement in November 1971, that direct disposal of snow to watercourses should be eliminated wherever possible.

This decision was reached after studies conducted under the direction of a Task Force, made up of representatives from Environment Ontario and several other provincial ministries, the Federal Department of the Environment and a number of municipalities throughout Ontario.

### SNOW STUDIES

A second task force contin-

ued these studies in an attempt to formulate a policy on snow disposal that would be acceptable to the entire province. An evaluation of data collected by the task force indicated that the quality of pollutants found in the snow varies considerably from region to region. Studies will therefore continue to more fully determine the optimum course of action that should be taken by the province.

For this winter the ban on dumping into watercourses continues, but with one change.

Allowances are made for emergency conditions.

For example after a heavy snowfall, dumping into a watercourse would be allowed if alternative means of disposal were not available.

### PERMISSION

However, an application for direct disposal is required by the Ministry of the Environment prior to the commencement of such disposal. The snow must also be of "suitable quality", that is not more than 48 hours old. The longer the snow sits the greater the concentration of contaminants.

The receiving watercourse is evaluated by the Ministry and permission to dispose of the snow in this manner is then

granted or denied.

Environment Minister James Auld has stated that there would be instances where suitable land sites were not available, and that direct dumping into a watercourse would be inevitable. However, he stressed that the Ministry of the Environment would work closely with municipalities to find suitable land sites and ensure that dumping of snow into Ontario's lakes and rivers is held to a minimum.

Several municipalities, including Metro and the City of Toronto, met with Ministry representatives and requested permission to dump directly into watercourses should such an emergency situation arise.

One of the areas without land sites for dumping was the downtown core of Toronto, bordered by Victoria Park, Bloor Street and the Humber River. The sites that were used the previous winter, the old Mercer Reformatory grounds and Toronto Harbor Commission property, were unavailable for 72-73.

### APPROVAL

The Ministry of the Environment gave verbal approval to the dumping of snow into Toronto Harbor pending the

finding of other suitable land sites.

However, by Friday—December 15, the Toronto Harbor Commission had given conditional approval to the use of their property for snow dumping, but for this season only.

Meanwhile, the City has assured Environment Ontario that consulting engineers will find other suitable land sites in the Toronto area by next winter.

There is no simple solution to the disposal of snow.

The use of less salt can help. If there are indications of a warming trend, road crews will let some of it sit and melt instead of pushing it to the side of the road. Sort of a "Snow-Show it or Leave it" situation.

Whatever plans materialize to combat the snow disposal problem, one fact still remains... short of putting a roof over the province there will be snow on the roads and lots of it.

It seems there's no business like snow business.

## CIC Meetings

The Chemical Institute of Canada is sponsoring two conferences to be held in Toronto and Montreal on March 21 and 22 respectively.

Canadian and American speakers will discuss future legislation and law enforcement relating to paint technology as well as coatings for automotive, coils, raw materials cans and equipment.

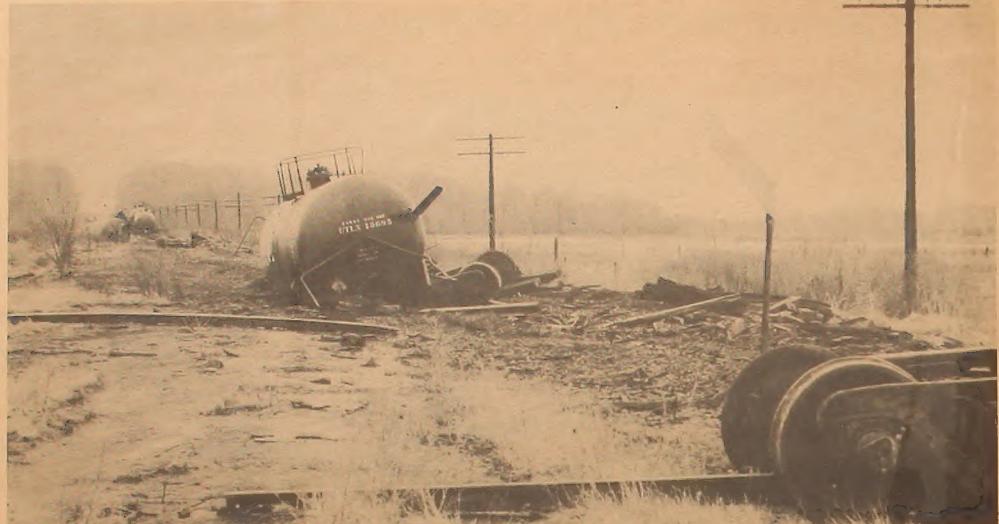
Tibor Perlus of the Ontario Research Foundation will be general chairman.

### AIR CONFERENCE

The Third Annual Industrial Air Pollution Conference

will be held March 29-30 at the Hyatt Regency Hotel, Knoxville, Tennessee. The conference will be co-sponsored by the Department of Civil Engineering of the University of Tennessee through the University of Tennessee Division of Continuing Education and the Southern Section APCA.

In addition to these pertinent topics, there will be technical sessions covering ambient monitoring and source sampling techniques and application of these techniques to industrial operation.



Bent rails, splintered ties and tank cars in pieces stretch along the Toronto, Hamilton and Buffalo line at the scene of the derailment.

## Crews clean up tons of acid

The scene was spectacular—a jumbled heap of toppled and split tank cars, steel rails and ties flung yards from their original line and dark, menacing liquid flowing along drainage ditches from the wreck.

Late December 1, 1972, a

false train derailed, dumping 1,500 tons of sulphuric acid, 93 percent pure, across farmlands and down sideroad ditches in the Pelham area just outside Welland.

Police, works department crews and firemen from Niagara region were first on the

scene, starting emergency measures even as the first reports came to set the Ministry of the Environment's oil and chemical spill contingency plan into action.

The policemen cordoned off the area to keep the curious from a dangerous area. The

works crews set to work building dikes to stem the flow of the spilled acid, containing most of it within the half mile immediately down grade from the wreck.

All homes in the immediate area were warned of the danger and a number of families evacuated.

While some lime was applied to spilled acid in the immediate area of the wreckage, the bulk of the cleanup had yet to get under way.

Early the next day, police flew over the area in a light plane. The aerial photographs they took indicated clearly, with black streaks and splotches on the snow-covered fields, the paths the acid had taken.

And the cleanup began in earnest.

### PLAN OF ACTION

A Ministry of the Environment co-ordinating team began directing operations and ordering neutralizing materials to counteract the almost-pure acid lying in the ditches.

At the same time, a back hoe was set to work, digging a series of lagoons into which the liquid from the ditches could be drained.

A quick thaw swelled the ditches with water and acid and enough of the corrosive substance overflowed the dikes to kill fish in a runoff stream leading to the Welland river. But the lagoons took and held the bulk of the acid solution to keep the river itself from harming.

Staff from Environment Ontario and the local Medical Officer of Health started sampling water in the wells surrounding the wreck and gave them all a clean bill of health. This checking was continued over the next few weeks to reassure residents of the safety of their water.

Almost all of the families

who left their homes the night of the wreck, were back in them three days later, as Environment Minister James Auld reported to the Legislature on the spill, after visiting the site.

At that time some 2,200 tons of soda ash and 10 tons of caustic soda had been trucked to the spill site to neutralize the sulphuric acid and more was on the way.

### CO-OPERATION

He congratulated the Niagara police and works crews for the prompt and effective action the night of the spill and commended the co-operative attitude of local residents.

Mr. Auld also mentioned Allied Chemical in Amherstburg for providing large quantities of soda ash on a moment's notice and Union Carbide for providing unload-ing facilities.

Within about two weeks, the acid had been neutralized, the lagoons pumped out and the remaining contents of the wrecked tank cars pumped out and taken away.

Early in January, a month after the spill, Environment Ontario's operations team were directing the restoration process—returning the land around the wreck to its original condition before the spill.

### COSTS AND BENEFITS

The total cost of the spill and cleanup may never be es-tablished.

It's probable that no bill will be presented for the long hours put in through the month-long work by civic and provincial officials.

The work provided positive benefits—experience in dealing with large quantities of a corrosive substance spilled in an inhabited area. And Environment Ontario is using the experience to further refine its spill response operations to deal effectively with major threats to the environment.



Environment Minister James Auld inspects acid neutralization work at the spill scene.



Bulldozer, in a blizzard of caustic soda and soda ash moves materials into lagoon to neutralize acid.



Backhoe was used to build a series of holding lagoons where acid was held for neutralization.



What sulphuric acid does to vegetation-normal on left.



At the site, (left) Mr. Auld is interviewed by local press. Below, "high acid" mark shows in ditch, with resultant vegetation damage.





A dynamometer gives data on this car's emissions under running conditions.

## Section tests 9000 cars

In the past three years, the automobile emissions section of the air management branch has tested more than 9000 cars during its spot check program in various Ontario cities and towns.

Most of these vehicles were post-1968 models because the program was aimed at cars produced after the passage of The Air Pollution Control Act, 1967. However, about 600 pre-1968 cars have been tested.

Current legislation states that emission control devices must not be tampered with or removed from passenger cars, but of the total of cars tested, only one per cent showed signs of alteration or tampering with these controls.

### INSPECTION

Under current federal and provincial laws, the federal authorities assume responsibility for seeing that emission controls are installed at point of manufacture, and the province's job is one of inspection to check the functioning of these controls after the vehicles are sold, and in daily use.

The Automobile Emissions Section approaches the auto pollution problem on two fronts, educationally and in the field.

Two specially equipped testing vans tour the province for five months from June to October.

These rolling labs are fitted with the latest gas analyzing equipment, including infra-red analyzers for the detection and measurement of carbon monoxide and hydrocarbons, a portable dynamometer for static testing under varying load and speed conditions, examples of testing equipment designed for use in dealerships, service centers and used car lots, and a smoke densitometer for checking diesel powered vehicles.

When a testing unit pulls into a town or city, it is usually located on a parking lot or side street. With the assistance of the local police, post-1969 cars are selected at random and put through a two hot cycle, seven-mode, seven-cycle test which includes running at varying speeds on the dynamometer up to 50 mph. The car's emissions are plotted on a

chart recorder and indications for CO and HC levels are read out on a testing machine.

### SEE CONDITION

The car's owner can graphically see the condition of his or her vehicle, and the operators are able to pinpoint trouble areas.

In many cases, it's found that a spark plug is misfiring, or a carburetor is out of adjustment. Often, emission controls have either been improperly serviced, or not serviced at all. In any case, most owners are glad to be told that their cars are not running at their best.

### EDUCATION

Education is the second important task of the section. In 1973, the mobile labs will visit nine community colleges (Windsor, Guelph, Hamilton, Scarborough, Sault Ste. Marie, Cornwall, Belleville and Ottawa), from October through June.

The special equipment used by the lab personnel is demonstrated with special emphasis on correct tuning and maintenance procedures for emission equipment.

Future mechanics will have to be knowledgeable about control equipment, and of course, many of these mechanics will be graduates of the community colleges. In addition, the vans carry various types of testing equipment that can be used in a small operation such as a service station or dealership.

Pre-1969 cars are not overlooked in the program. Tuning and servicing procedures are stressed to assure that pollutants are kept to as low a level as possible.

### COST VS. NEED

Future standards will call for drastically reduced levels of hydrocarbons, carbon monoxide and oxides of nitrogen. The environmental protection agency in the United States has set standards which at this point, are to be followed exactly by the federal government in Canada. These call for a reduction by 1975 to 0.41 grams per vehicle mile of hydrocarbons and 3.4 grams per mile of carbon monoxide. By 1976, oxides of nitrogen are expected to be down to 0.4 grams per mile. Whether these standards will be adopted by the province of Ontario is an open question.

## Four auto emissions need controlling

Automobile exhaust can be dangerous if produced in an unventilated area. It is also a major source of air pollution.

In addition to water vapor and carbon dioxide, it produces amounts of carbon monoxide, a colorless, odorless lethal gas, unburned hydrocarbons, which along with oxides of nitrogen react with sunlight to produce photochemical smog, that eye-irritating, annoying haze commonly linked with air problems in Los Angeles, California.

The fourth product of internal combustion is lead. This element, combined with amounts of lead already in the atmosphere could constitute a health hazard if left unchecked.

Pollution from the automobile has become a problem because of incomplete combustion of gasoline. When there is enough oxygen combined with the fuel mixture, gasoline is converted into harmless carbon dioxide and water vapor.

### INEFFICIENT

Inefficient combustion produces carbon monoxide, hydrocarbons and oxides of nitrogen (however, very efficient combustion such as that in a gas turbine also produces high amounts of NO<sub>x</sub>).

There are various reasons for incomplete combustion, among them poor mixing of air and fuel (maladjusted carburetor), short combustion time and quenching of the burning process near a cool chamber wall (dead space where the combustion flame is unable to penetrate).

Some of these problems can be eliminated by heating the fuel mixture before it is admitted to the combustion chamber or substituting a fuel injection system for the carburetor.

A positive crankcase ventilation valve (PCV) is usually included. This feeds crankcase vapors back to the combustion chamber where they are burned.

Gasoline fumes can be a problem when a car is at rest or at idle. They tend to leak from the gas tank filler cap and the carburetor, adding to the pollutants in the atmosphere. Closing this system at its outlets and installing a charcoal canister has proven to be the solution. The vapors are trapped in the charcoal and are drawn into the engine and burned when the engine is started.

There are four ways manufacturers have used to cut down pollution:

### CONTROLLED TUNING

The first involves fine tuning of the carburetor and spark

timing. At the factory, the carburetor is set and sealed to stop possible tampering. In addition, the mixture strength is leaned-out at a ratio of roughly one part fuel to 14 parts air.

Spark timing is also advanced or retarded, depending on the characteristics of the engine. There is usually a fitting to recirculate exhaust gases to the carburetor for more complete combustion.

### AIR INJECTION

A simple engine-driven device pumps air into the exhaust manifold, raising the temperature of the gases to the point where they burn off.

Most of the polluting components are reduced to water vapor and carbon dioxide before they pass out of the tailpipe.

### FUEL INJECTION

In place of a carburetor, a fuel injection system accurately meters fuel to the combustion chamber (fuel injection systems are both mechanically and electronically controlled). This produces far better combustion than a carbureted engine. Under deceleration, a fuel injection system cuts off the fuel supply, a time when a carburetor causes a high pollution output.

Many imported cars use fuel injection, but so far domestic makers have stayed with the carburetor and variations on control methods described in the previous paragraphs.

### CATALYTIC MUFFLERS

The catalyst method will come into fairly general use in the next few years. The muffler uses a catalyst (in some cases, platinum) to oxidize toxic gases in the exhaust. However, cars equipped with these mufflers will have to use leaded gasolines, exclusively. (Lead reacts with the catalyst to destroy the muffler's effectiveness.)

One major manufacturer has announced the intention to install these mufflers on 1974 vehicles, but the whole issue is in some doubt at this point. There is considerable controversy at the present time as to whether this type of muffler should be put into use.

This, along with the continuing problem of the costs of the catalyst and the expected increased price of fuel due to the incredible cost of changing over to unleaded gasolines on a nationwide basis. (The average cost of altering gas stations has been estimated at \$6,000 per installation.)

The total cost to the Canadian refining industry has been estimated to be as high as \$820 million, with added yearly costs of \$220 million.



A few adjustments under the hood get the car running its cleanest.

# Horses of a different color

## Internal combustion

Suck, squeeze, bang, phooie.

It has a silly sound to it, but that is the basic series of events inside the internal combustion engine, the power plant that runs 99.9 percent of the autos on our highways.

Suck? Well, an intake valve opens and the piston descending in its cylinder draws in a mixture of air and gasoline.

The squeeze comes in when the valve closes and the piston rises again to compress the mixture in the cylinder.

Then Bang!—a spark leaps the gap in the spark plug to explode the mixture driving the piston back down.

## Electricity hums from the past

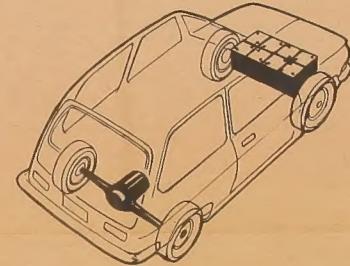
Sixty years ago the electric car had a strong place on the market. It had the twin blessings of almost total silence and utter simplicity, making it popular with genteel ladies.

However, it wasn't fast, and was burdened with a load of almost a ton of brutally heavy storage batteries that needed recharging after each day's use. The gas-powered car improved rapidly, and soon the electric was relegated to museums. Now, with so much interest in the search for a truly non-polluting car, the electric could make a mild comeback.

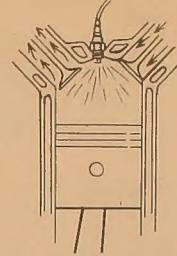
The argument has been raised that a superb electric car could be built and sold if modern technology was expended on the design. The biggest stumbling block is the power source. There are lightweight

As the piston again rises, the exhaust valve opens allowing the burned air and gasoline mixture to go into the exhaust manifold phooie.

Just multiply this by four, six, eight or 12 cylinders, add in a camshaft and maybe some pushrods to run the valves in their proper order and an electrical system to keep the plugs firing at the right times and you have the basic internal combustion engine. It's bulky, it has a lot of moving parts and in spite of its 70-odd years of development, it cannot meet the 1975 exhaust emission standards without space-consuming, under-hood, accessory controls.



batteries available, but their cost is ten times that of the good old-fashioned lead/acid type, so it's the lead acid pow-

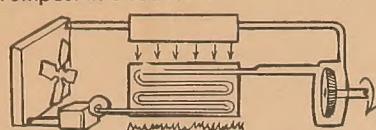


er model that will most likely find use, probably in small commuter or shopping vehicles. There are a few companies in the United States engaged in changing small imported cars to all-electric operation, at a cost of roughly \$5,000 per unit.

Like its ancestor, a modern electric must recharge its batteries overnight, and an average daily range could top 80 miles, at an average speed of not over 40 mph. Any faster, and this range would be considerably less.

The drawing above shows a typical sub-compact electric layout. Motor is built into rear axle housing.

## Tempest in a teakettle



In steam systems, all combustion is external—outside the powerplant proper.

Usually, water is boiled and the steam's expansion is used to turn a turbine wheel connected to a drive shaft. The spent steam is fed through a regenerator to recover some of its heat to pass on to the next cycle, then to a cooling, condensing stage to begin the cycle again as water.

While emissions are potentially lower with steam, there are two major problems in this system at present—fuel econo-

my and heat.

One of the most successful experiments could get only 3.8 miles per gallon in city driving.

Even more significant is heat—the experimenters have been forced either to install heavy condensing equipment or to allow some of the water to evaporate into the air, creating a need for refill of the water tanks as well as the fuel tanks.

At the moment, steam hardware can add up to 500 pounds of weight over the internal combustion engine and produce only half the power.

## The diesel runs on oil

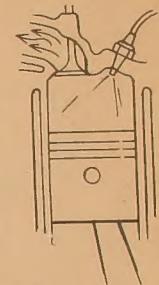
The Diesel engine is remarkably like the normal gasoline engine except that the spark plug is replaced by a jet nozzle that pumps fuel into the combustion chamber.

The intake valve lets in only air which mixes with fuel in the chamber. Otherwise the process of compression, explosion, exhaust and intake is the same.

Instead of the mixture being fired by an electrical spark, however, it ignites by spontaneous combustion under the high compression in the engine.

This leads to this type of engine's main disadvantages. It is heavy and bulky for the amount of power it puts out—about twice the weight and size of a gasoline engine of comparable power.

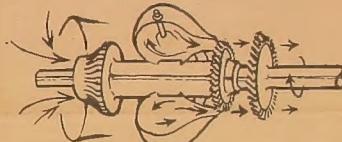
In addition, the diesel process produces almost no carbon monoxide. While this is an



asset in one way, it creates a problem. Carbon monoxide mixes with oxides of nitrogen, another problem emission, helping reduce it to harmless nitrogen and water vapor.

As diesel engines, because of the difficulty of lowering nitrogen oxide emissions, among other drawbacks, are not a viable alternative.

## Wheels going round make the car wheels go around



In the gas turbine engine, a compressor wheel draws in and compresses air, pumping it through a regenerator where heated exhaust waste is added, into a combustion chamber that encircles the turbine shaft.

Here, the heated air is mixed with fuel and ignited. Combustion is continuous with the expanded burning gases rushing down the shaft to turn impeller blades mounted on

the shaft. The hot exhaust is routed through the regenerator before its discharge into the atmosphere.

The main defects of the turbine are costs—because of the high temperatures involved, expensive alloys are needed in the combustor and nitrogen oxides. Nitrogen oxides are a product of high temperature combustion and turbines need high heat to work efficiently.

## Propane fuel being tested in fleet use

It has been shown conclusively that vehicles that have been converted to either of these gaseous fuels show a marked drop in emissions, and as an added benefit much longer spark plug life and longer times between oil changes.

Thus far, their use has been restricted in most cases to fleet use.

A large utility company has test-operated dual fuel vehicles (gasoline and LNG, with the LNG used for in-city operation and gasoline for highway driving). In fleet operation, the vehicles return each evening to a central fuel storage point, making fuel availability a simple matter. It's unlikely the average motorist will ever be able to use propane or LNG because of distribution problems.

### INDOORS

Propane has found wide use in small forklift vehicles because these are used indoors, and the low-pollution advantages of this fuel are obvious. Conversion to propane involves removal of the normal

fuel tank and the substitution of round cylinders. (Propane is stored under pressure so this calls for this kind of tank.) The entire fuel feed supply to the carburetor is removed, and a propane system consisting of the pressurized tank, a filter and lock-off valve (including a fail-safe switch) a converter and carburetor are fitted.

The gasoline fuel lines can be replaced with either copper tubing or better, steel-braded hose. The engine itself does not require any attention. The fuel tank is equipped with an overflow valve to prevent filling over 85 per cent of capacity and a snap-fitting must be used because propane is under pressure of approximately 150 pounds per square inch. The propane tank is heavier than a gas tank but this is offset by the fuel's lower weight (a specific gravity of 5.1 as against gasoline's 7.8) and of course it does take up more trunk space.

In commercial vehicles this is not a problem.

# EcoLogic

## Vintage year

In environmental circles, 1972 may go down as a vintage year—the best of the past several decades.

During the past year, there have been more and more signs that pollution control has become part of our lives—at a personal level, at a community level, at provincial and national levels and even on the international scene.

The United Nations Conference on the Human Environment last summer in Stockholm brought little in immediate tangible results. But it touched a spark of international warmth—a spark that can grow in the future to melt away the chilling prospects posed by the Club of Rome's report, *The Limits to Growth*.

In brief, the report sees the world facing a predicament: The accelerating production of the developed nations and accelerating reproduction in the undeveloped countries are racing toward fixed limits in natural resources and living space.

But as the first world-wide meeting of minds, the Stockholm conference holds out promise of eventual international co-operation to solve this dilemma.

The promise is inherent in the Earthwatch proposal—a scheme for a global pollution monitoring network that we in Ontario are already prepared to take part in.

It's too soon to tell whether Canada's decision to abandon its east coast whaling activities will slow or halt the greedy pursuit of these disappearing mammals by such nations as Japan and Russia. But there's a possibility that one nation's example could eventually be the salvation of at least some of earth's largest creatures.

Certainly international co-operation can work. Its effectiveness is best shown in the relationship between Ontario and her neighbor states in the U.S.

Michigan's director of public health last summer was quick to set up an investigation with his own staff when dust fallout in the Sarnia area was traced to U.S. sources.

A similar high degree of co-operation was evident in late December when Windsor's air pollution index rose over 32. When Environment Ontario's air management branch notified officials in Michigan's Wayne County, their action was passed on to the Detroit-Edison power plant at River Rouge. The power plant immediately volunteered to cut back its operation if Ontario's index reached 50. Under U.S. current standards, the plant would not be required to cut back until the index passed 100.

On a federal level, the Canada-U.S. Great Lakes pact and President Nixon's visit to Ottawa to sign the Great Lakes agreement hold out much hope for the future of restoring the Great Lakes to purity.

But this is a situation where Ontario is left with some concern as we go into the new year. As Environment Minister James Auld commented recently: "The point is that we do not know the actual extent of the U.S. effort in the Great Lakes because the states and the federal government are presently negotiating this position."

While Ontario has met and is continuing to meet its clean-up program along the lakes, we are still not sure of the amount of federal money that will underwrite and determine the extent of the U.S. effort.

In Ontario, environmental protection agencies have been united in a new structure, the Ministry of the Environment, for more than nine months. The keystone legislation, The Environmental Protection Act, 1971, has been amended to increase its effectiveness.

In the midst of reorganization, control programs have continued without hesitation and a number of new areas have been explored.

For example, the field of waste management is under development with a solid waste task force expected to report in 1973. And the Ministry's prompt action to stop the proliferation of non-returnable three-quart milk containers met with enthusiastic public support.

We are at the point where a general improvement in air and water quality has become evident across the province and where all major pollution sources are identified and to a great extent on control programs.

More and more attention is being directed to specific localized problems.

The key to this type of work is communication—letting people know that Environment Ontario deals with pollution so these problems are brought to the agency that can solve them and keep everyone involved in the fight for a clean environment.

Public participation is a major part of the future of environmental management.



Reproduced from Thunder Bay's *The Stirring Giant*.

## How many parts in the average M?

The term "parts per million" is one that's becoming more and more familiar to the general public, but how do you really describe a measurement like this in easily-understood terms?

In a recent edition of the *Forecast Research Newsletter*, some comparisons were made worth passing on. They help to give a more concrete view of how small a concentration is represented by this term.

"One inch in 16 miles is one part per million."

"One part per million is a minute in two years."

"Your hand on the ground covers five parts per million of one acre."

"A postage stamp is one part per million to the weight of an average adult."

## To resolve the Doom Debate

The Canadian Senate has proposed the creation of a permanent Commission on the Future. Senator Maurice Lamontagne said recently in an address to the Society of Chemical Industry in Toronto.

A conference is set for October, 1973 to establish this body as a beginning in the confrontation and resolution of the Doom Debate—the global controversy centering around accelerating production and reproduction in a world of finite resources.

"If the commission proves to be a success in our country," Senator Lamontagne said, "other nations will undoubtedly be encouraged to follow the same approach. This, in my view, is the only acceptable way to prevent the further disintegration of our affluent societies and to prepare the intellectual and moral conversion of the West."

"The other alternative, as history clearly shows, is the possible rise of political dictatorships and the inevitable decline in our civilization."

### DOOM DEBATE

The controversy now described as the Doom Debate was precipitated by the publication of *The Limits To Growth* by the Club of Rome, an informal organization of about 60 individuals, including Senator Lamontagne, from around the world.

He described the Club of Rome's purpose as "fostering a better understanding of the varied but interdependent components—economic, political, natural and technological—that make up the global system in which we all live." This informal association took up a massive project called the Predication of Mankind.

The basic issues of the controversy that resulted were summarized by the Senator.

### POPULATION GROWTH

"It took more than eight million years for world population to grow to one billion in 1850. However, only 75 years were required—from 1850 to 1925 to reach two billion, and 37 years—from 1925 to 1962—to get to three billion. It is estimated that it will take 13 years, from 1962 to 1975, to arrive at four billion. World population was estimated at 3.6 billion in 1970 and if current trends continue to prevail,

it may reach seven billion in the year 2,000."

Similarly, Senator Lamontagne said, world industrial production has increased geometrically with a growth rate from 1963 to 1968 of seven percent a year, a doubling time of 10 years. The Limits To Growth also indicated that pollution and the consumption of non-renewable resources are also increasing exponentially.

He put the fundamental problem into two questions: "Can exponential growth go on forever? If not, how can it be stopped without a major world catastrophe?"

### LIMITED WORLD

He said man is locked into a system of increasing without limit within a world that is limited. In developing countries, this takes the form of population growth—reproduction. In developed countries, the form taken is that of industrial growth—production.

This is the stage at which the Doom Debate begins, the Senator said. Optimists argue that exponential growth can continue almost indefinitely, leading developing countries to the stage of their economic take-

off which will allow them to check their population explosion and narrow the affluence gap between the two worlds.

The pessimistic viewpoint is that the exponential growth that we have experienced over the past century will strain the limits of world resources within a few decades and if man does not stop himself, nature will stop him.

### TWO QUESTIONS

Beyond this debate, said Senator Lamontagne, lie two fundamental questions.

"Will the Western world follow a pattern of social and moral disintegration and decline like all the great civilizations of the past?"

"Will we be able to develop new moral resources which will enable us to renounce exponential growth deliberately or, at least, to improve the quality of our lives in order to check the powerful solvent that affluence contains?"

He concluded that the Senate Committee's permanent commission may be one way out. "This is the age of involvement and it is nowhere more necessary to involve people than with the future."

## U.S. firm praised for cutback offer

On Tuesday, December 12, 1972, the Detroit Edison power plant at River Rouge, Michigan voluntarily prepared to cut back generating activities if the air pollution levels

at Windsor, Ontario reached a reading of over 32, the advisory level. The reading that day reached a high of 36, which called for an advisory to major sources of pollution to be ready to curtail operations if weather conditions contributing to the problem were likely to continue.

Mandatory cutbacks are not ordered by the air management branch until the index reaches 50, but Ontario Hydro immediately reduced emissions at its Keith St. plant by 50 per cent.

The air management branch of the Ministry advised the Wayne County air pollution control office, which in turn alerted the Detroit

plant. The power station set plans in motion to cut back power if Windsor's index reached 50, following Ontario's guidelines.

### ACTION PRAISED

Minister of the Environment James Auld praised Detroit Edison's action in light of the fact that under American rules, the utility would not have had to cut back activities until the index reached the equivalent of 100 on the Ontario scale.

"It is unlikely this reading would have occurred on the American side because the wind was blowing in the wrong direction," he said.

Before midnight on Tuesday the winds changed direction and the advisory was ended. The Windsor level dropped to 31 at 1:00 a.m. and by 8 a.m. the following morning it had declined to 28.